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A Simplified Accident Scenario

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Objectives

- Propose a simplified but representative severe accident scenario
 - For the new fuel/cladding types to be measured against
- Simplified and generic
 - Applicable to many reactor designs
 - No event-specific operator actions
 - Should envelope all realistic LOCA accidents, e.g., Station Blackout
- After the core has been uncovered, no operator interaction
 - The system is let go until core integrity is lost

Proposal

- Zion Station Blackout scenario
 - Calculated using MAAP
 - 4-loop Westinghouse PWR
- Disabling creep rupture
 - No system depressurization
 - Conservative assumption
- Complete absence of active cooling
 - Temperature evolution envelopes other, less severe accidents
- Scenario probably applicable to PWR and BWR
 - Starting the clock when the core begins to uncover

Severe Accident Modeling of a PWR Core with Different Cladding Materials

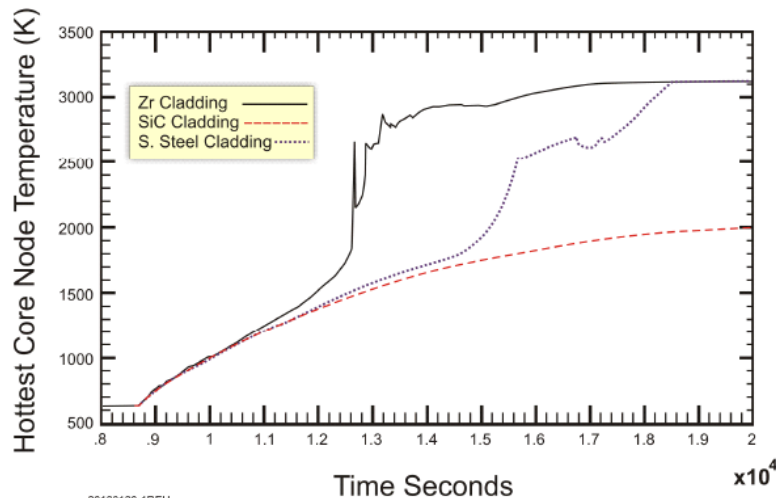
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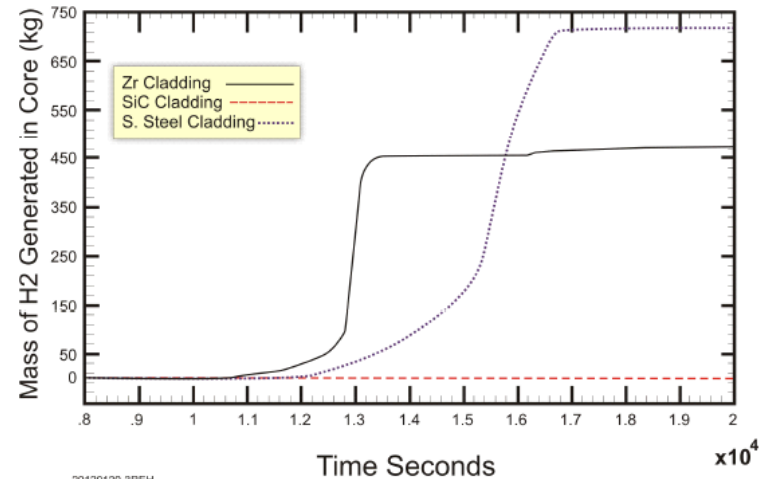
Proceedings of ICAPP '12
Chicago, USA, June 24-28, 2012
Paper 12175

Proposal – Cont'd



20120120-1REH

Fig. 8. MAAP evaluations for the hottest node in the reactor core for a PWR station blackout sequence with hot leg creep rupture disabled for the calculation.



20120120-3REH

Fig. 9. Mass of hydrogen generated within the core for a station blackout sequence in which hot leg creep rupture has been disabled.

- Calculation is extended until the core has disintegrated
- The "SiC" curve reflects an assumed perfectly inert cladding
 - Any significant cladding-steam reaction will lead to higher temperatures
 - Should be included in materials-specific application of the model

Suggested parameters to calculate

- Cladding-steam reaction rate
 - Enhances temperature and hydrogen generation
 - Feeds back on reaction rate
 - Coated cladding will have a two-tiered behavior
- Release of fuel and fission products
 - After first penetration of cladding
- Time to core disintegration
 - Melting of fuel
 - *or*
 - Gross failure of cladding